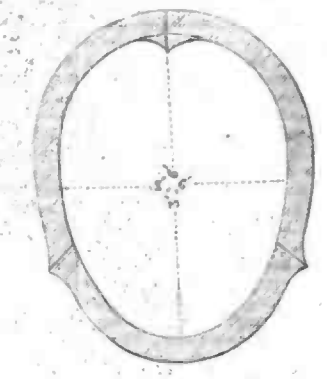
the construction of conduits for sewerage, it will apparent no brick building or masonry (if my data be correct, of which I have now no doubt) could at all be made available for cases so small as that which I contemplated introducing. I therefore consulted with the manufacturers of tubes of Terra Cotta and different other kinds of clay as to their expense, and the probable strength which might be given to tubes of from two to eighteen inches diameter, and the result was, in all respects, so satisfactory, that I soon came to the conclusion, that no house drains or private sewers could, by possibility, be perfect in their operations, if built either of brick or stone, and that the substitution of strong tubes of small calibre made of indestructible materials would be found an invaluable improvement. As the strength of the tubes which I propose using as conduits for sewerage has frequently been questioned, I beg to submit the following fact, which proves indisputably that objections to my system, founded on this basis, are perfectly untenable. A few specimens of fire-clay tubes were manufactured in the neighbourhood of Glasgow by the Garnkirtan Coal Company, and these were, in the presence of a number of scientific and interested gentlemen, tested by hydraulic pressure, when it appeared that it was not until a greater pressure than that equal to a perpendicular column of water 300 feet had been applied, that they could be burst. I was not present when the experiment was made, but Mr. Smith of Deanston, and several distinguished persons who were, informed me of the fact. But a moment's consideration will serve to convince any one that a conduit for any fluid must be stronger, if formed in complete circles, than if made up of numerous small fragments which have no affinity for each other; in fact, which only preserve a form or shape by the sheer force of their surrounding and superincumbent pressure. Two years have elapsed since I first mooted this idea, and I have much satisfaction in now being able to state that the principle was at once conceded by scientific persons while I was in London; and that since my return to Scotland, there has not been a single sewer built either of stone or brick in the town of Ayr—clay tubes have invariably superseded them. The Ayr arrangements, however, I am sorry I cannot altogether approve of, because no principle seems to have been recognized; all that appears to have been thought necessary, was the adoption of circular clay tubes, instead of the old expensive rude brick or rubble-built drains. Notwithstanding this, the people are unanimous as to the great advantage which the tubes possess over the old system. The sizes employed are from nine to eighteen inches dimensions, which, for reasons here stated, and which also appear in the body of my evidence, I entirely disapprove of for the purposes of mere house drainage. The tubes should be made of fire-clay and glazed; the glazing does not add sensibly to the cost, and would be a great improvement. It may be interesting here to remark, that I was particularly struck during my stay in Ayr by observing the loss which a community sustains from the want of combined action.

If public companies, curators of local trusts, and private persons, were to digest properly their schemes, and cordially to co-operate, it is easily demonstrable, that much economy in every sense of the term would invariably be experienced. In the town of Ayr they have no Act empowering the authorities to cause inhabitants to adopt such arrangements as have recently been shewn to be indispensable for the protection and preservation of public health; therefore every man who desires to improve his premises, entertains that desire from a conviction of the necessity for making certain alterations, in order that the health and comfort of his family may be secured. But as there have, in this place, been no public meetings to discuss the merits of those suggestions, which have been offered for the general improvement of the town, every one must proceed as his own architect or builder may choose to dictate, irrespective of his next door neighbour's operations. Each who desires to lead his soil drain into the main, must make his own direct communication with the main. I have endeavoured to point out the folly of such proceedings, by shewing to the parties the vast saving, which would be effected if neighbours would only consult each other, and harmoniously co-operate.

I shewed, to the satisfaction of competent persons in Ayr, that if proprietors in the lower and descending parts of streets would allow the landlords on the higher grounds to make connections with the private drains of those as they descended, each bearing his own expenses, or such proportion as might be required to convey the tube past his property, that then one connection only with the main would be necessary, for a number; the expense of making which, if divided amongst a number, would be comparatively trifling. This system which I propose, I have no doubt will, ere long, be universal, as its advantages are obvious. Having sufficiently and satisfactorily established the principle that all drains or sewers ought to bear positive reference to the quantity of water, &c. which it can be calculated they would be required to convey, and having ascertained that in the case of small or house drains, this was matter of easy accomplishment, I next directed my attention to the common or main receiving sewers, and with a view to shew that the same principle which prevails in the small, will also be found to regulate the large, I consulted scientific and practical men as to the possibility of constructing sewers into two, or three, or four pieces, instead of the common tedious, imperfect, and expensive mode of brick building in cement or mortar. I proposed the adoption of pieces of fire-clay moulded in the most unobjectionable forms, and of great strength, which requisite, I was assured by the manufacturers, thickness and high temperature would, in the case of this material being employed, be certain to secure. The fixing upon the best configuration, now started up as a new difficulty; at last, however, I succeeded in convincing myself and such scientific friends as took interest in my pursuits, that the section of the form represented in the accompanying sketch



is decidedly more perfect than any thing that has hitherto been employed for sewering purposes. It has also been asked what pressure externally and internally would such a construction as this withstand, the answer is simple,—no superincumbent weight whatever could crush it (this the manufacturers one and all guarantee); the pressure which it would bear from within would be in the direct ratio of that from without; a glance at the diagram will shew, that, like a brick-built circle, it has no strength save that which it derives from the pressure of the surrounding materials. The cost of a sewer of the dimensions marked on the diagram, would be about 18s. or 1*l.* per yard. I find that fire-clay tubes 12 inches diameter, and 12 inches in length, can be purchased in Glasgow for 9d. per foot, or 2s. 3d. per yard, which is exactly *half* the prices furnished to me by the London manufacturers. The manner in which small or side drains are connected with this kind of sewer is simple; circular openings of various diameters are left at the time they are made in a great proportion of the side pieces, a little above that part where they rest on the invert, into which a tube of from 3 to 12 inches may be inserted, as the case might be.

The following is a calculation which I made while in London in April 17th, 1843, with a view to shew the economy which would be effected by the adoption of small strong tubes instead of brick-built sewers:—

Brick-built, first class, 2*l.* 10s. per yard =4,400*l.* per mile.

Brick-built, medium class, 1*l.* 10s. per yard =2,640*l.* per mile.

These are the prices of the Holborn and Finsbury metropolitan district of sewers, furnished to me by my friend Mr. Roe, Civil Engineer.

Tubes of terra cotta or fire-clay:—

Tubes of 1 foot 6 inches diameter, at 15s. per yard=1,320*l.* per mile.

Tubes of common brick clay:—

Very best, 1 foot diameter, at 3s. per yard =264*l.* per mile.

Prices of drain-tubes in Glasgow, of common clay, including flange of from one to two inches:—

3 inches diameter, 6d. per yard.
6 inches diameter, 9d. per yard.
9 inches diameter, 1s. per yard.
12 inches diameter, 1s. 3d. per yard.
18 inches diameter, 2s. per yard.

Tubes of cast-iron, of 12 inches diameter, would weigh about 2½ cwt. per yard, the cost of which would be 6s. 6d. per cwt., or say 14s. 6d. per yard, of a strength equal to 300 feet pressure, which would be=1,276*l.* per mile.

These prices, it is to be understood, are merely approximations, as the manufacturers were especially requested by me not to furnish me with quotations less than the present wholesale prices of the articles; so, of course, if a great demand were to take place for extensive sewering operations, there can be no doubt the materials could be had for little more than half the prices I have mentioned, more especially when it is known that the tubes can be manufactured with great rapidity by machines, driven either by steam or horse power. I have myself a working model for this purpose, which I invented three years ago, and which operates beautifully.

Earthenware pipes from the Shropshire Pottery may be obtained through Messrs. Darby and Co., Coal Brook Dale, Shropshire.

Fire-clay pipes, 4 inches diameter, 1s. per yard, and 6 inches diameter, 1s. 6d. per yard, from the Garnkirk Fire bricks, Glasgow.

There are a great many niceties to be attended to in the reducing this system to practice, so that its perfection may be completely brought out, and its efficiency of operation secured. The manner, for example, of connecting small tubes with each other, and these again with the great receiving or common sewer. The mode of keeping sewers free from deposit by flushing I have sufficiently explained in my evidence. I may, however, remark that if the tubular *system of sewering* were to be properly conducted, that no such flushing apparatus as that described by me, or any other contrivance for this purpose, would ever be required; and I am convinced that in a few years brick-built sewers will be but the *rare exceptions*; whole towns and cities will be sewered at small cost, and more perfectly than it is possible to accomplish by brick building. I purpose as speedily as possible publishing a small treatise on sewering, in which I mean to shew the objections which pertain to those colossal constructions that exist, and continue to be made in the metropolis; the means best calculated to remedy their defects; and lastly, describe the kind of sewering which I think unobjectionable, and what I would, therefore, recommend for adoption in all cases where new sewers are required.

In the mean time I shall only add, that it will afford me great pleasure to communicate with such parties as may desire to be informed on this interesting and important subject, and to furnish them with every information they may require, or that I am possessed of.

New Soldra.—Dissolve zink in muriatic acid to saturation, add pulverised sal ammonia to this solution, and after boiling it for a short time it is ready for use. In using this compound no cleaning of the metal is necessary, however oxidized, and oil and other materials are dispensed with. It is only necessary to apply with a piece of sponge upon a stick, or a feather, this solution to the part to be soldered in place of the material now used, to prevent oxidation and facilitate the flow of the solder. Such is the efficacy, that if two pieces of bar, possessing considerable surface, be wet with this solution and pressed together, upon the application of the soldering tool, the solder will at once flow between the plates throughout. —*Mechanics' Magazine.*

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